

A New Approach to Optimising Supply-Chain Performance Using 4 Fundamental Process Types

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Abstract

“Supply-chain complexity” is often in the eyes of the beholder. The authors offer a simpler perspective - introducing an approach, appropriate measurement metrics and methods, that will deliver sustained improvement to supply-chain performance.

The authors posit that all businesses operate up to 4 fundamental process-types. By recognising that what is commonly described as supply-chain mainly comprises 2 (of these 4) process-types, this paper illustrates how a select set of key metrics, and measurement method, enable organisations operating any supply-chain model to continuously improve production processes, inventory levels, throughput time and customer experience.

Keywords: Systems-thinking; Processes; Improvement

1. Introduction

The literature defining “Supply-chain Management” is voluminous, and varies from simply “managing logistics” to the whole “end to end obtaining raw material from the planet to final delivery to the consumer”. Wikipedia, a source to which many turn today, states: “... there is no theoretical support for explaining the existence or the boundaries of supply-chain management”, and goes on to quote no less than 23 associated organisational theories that may contribute. So there is a Theory Gap.

In addition, there is some ambiguity around performance measurement, especially what to measure (“internal measures are generally collected and analysed by the firm, including cost, customer service, productivity, asset measurement, and quality. External performance is measured through customer perception measures and ‘best practice’ benchmarking”), and there is nothing on how to measure. So there is a Performance Measurement Gap. By considering supply-chain as a combination of 2, possibly up to 4, of a total set of 4 fundamental process types – and (building on work by other authors / practitioners) applying Applied Systems-thinking[†], can this approach help bridge the Theory and Performance Measurement Gaps identified above, and offer a more effective / efficient path to sustained supply-chain performance improvement?

[†]Applied Systems-thinking: A working definition for the purposes of this paper is provided as follows:

- Define the Environment and the System (incorporating Changing Requirements / Systemic Change)
- Define System Purpose – e.g. “Deliver products & services on-time and in-full, at an acceptable price to the customer and at an acceptable cost to the business”
- Describe the System in terms of a high-level flow-model of key value-add processes and stages
- Derive a measurement-model based on the flow-model
- Utilise a set of standard measurement metrics
- Utilise a statistical measurement method to provide insight on performance
- From the insight, identify and prioritise and decide on issues for improvement action
- Apply improvement action
- Monitor the System for improvement outcomes.

2. The 4 fundamental process types

The authors have a combined experience of around 50 years in examining and improving business processes, both in the Public Sector (e.g. Emergency Services such as Police, Fire, Ambulance, Hospitals), and Private Sector (e.g. Pharmaceuticals, Telecommunications, Infrastructure Management). During this time, it has become clear that there are at most 4 key business processes at play in delivering any organisation’s Purpose. These are (see Figure 1):

- Concept to Deliver (C2D) or Concept to Market (C2M): Examples being pharmaceutical clinical trials; the Government Major Project Portfolio; new product / service development; construction projects.
- Lead to Cash (L2C): Examples being sale, manufacture and delivery of new cars; providing a new telecommunications service; sale of consumable products.
- Trouble to Resolve (T2R): Examples being IT help desk; repair and maintenance of rail infrastructure; police; making an insurance claim.

- Procure to Pay (P2P): Examples being procurement of defence system; procurement of consumables; procurement of services. This process could be extended further “upstream” to include decisions on sourcing partners – in which case it becomes Source to Pay (S2P).

Some Fundamentals - Operational Performance Management – Critical Processes

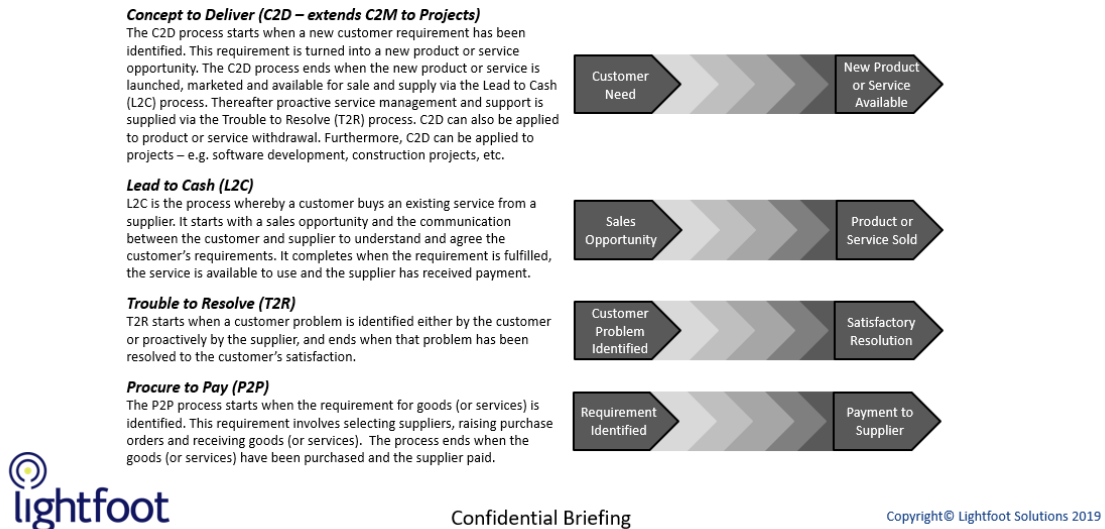


Figure 1. The 4 fundamental process types.

The authors posit that these 4 structures are as fundamental to business as the 4 “particles” are that make up the atomic model (electrons, protons, neutrons and quarks), and which holds true in solid, liquid or gas form and in every element, or as fundamental as the 4 nucleotides that make up DNA (adenine, cytosine, guanine and thymine) which holds true in any plant or animal or part thereof.

Naturally, there are other processes at work, for example:

- “Technical” processes, such as reporting to regulators, reporting financial results etc.
- “Supporting” processes, such as resourcing, recruitment, training, forecasting etc.

The difference is that, if either of these types of processes stopped for a period, they would not immediately threaten ability to trade.

The significance of seeing the business world through the 4 process-type lens is that the Theory Gap is bridged (there is a start and end to each process-type, and the management of each is straightforward without having to resort to multiple organisational theories), and the Performance Measurement Gap is bridged - absolute clarity can be driven into what the “measurement model” should comprise, and why it is so important for process management and improvement – see Section 3.

One critical observation is that the process types exist and are completely orthogonal or independent from the operational / geographic location models used to implement them.

2.1. Supply chain

The authors research over the past 20 or so years reveals a common process type structure underpinning so-called Supply-chain. Working with organisations such as BT, GSK, Novartis and others, Supply-chain can be broken down, essentially, into 2 process types, namely Lead to Cash (L2C) and Procure to Pay (P2P) – see Figure 2. The generally accepted fundamental model for describing Supply-chain is known as the SCOR (Supply Chain Operations Reference) model, developed by the Supply-chain Council (SCOR October 7, 2004), see Figure 3.

Enterprise Supply-chain Lifecycle

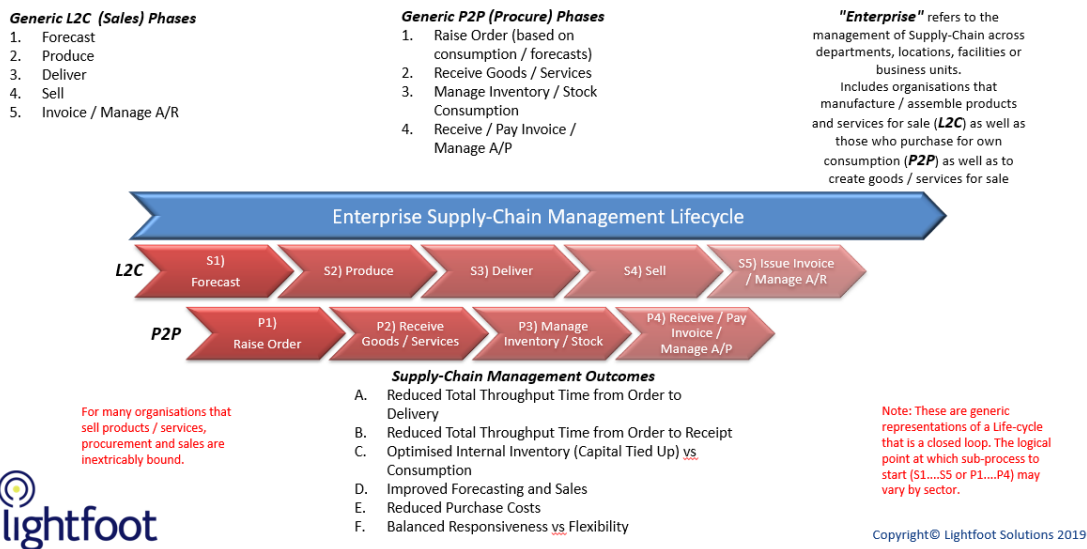


Figure 2. Supply chain as 2 fundamental process types.

SCOR Framework Levels

Supply-Chain Council

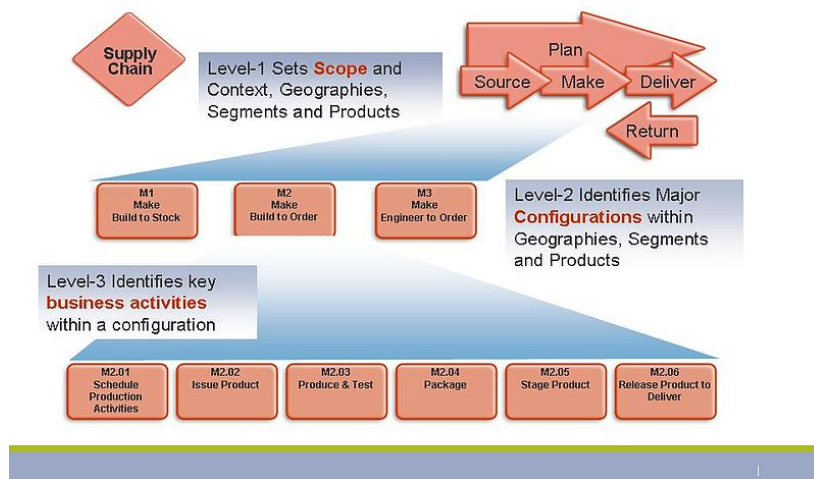


Figure 3. SCOR Model.

In an internal Lightfoot Solutions research paper, a mapping was developed between the SCOR model and the model depicted in Figure 3 (Chambers, Lightfoot Solutions, 2012). For the purpose of brevity, it will only be referenced here. Further details can be obtained from the authors.

The importance of adopting a fundamental process type model is that a compact, coherent set of measures (or metrics) become available for improving the processes. This contrasts with the plethora of metrics that can be found in the public domain, and especially counter to one of the so-called "Best Practice" metrics referred to as "Forecast Accuracy". An example of how misleading and unhelpful this metric can be is illustrated in Section 5.

2.2. Lead to Cash (L2C) and Procure to Pay (P2P) Processes

It is only necessary to consider the next constituent level breakdown of each of the L2C and P2P processes in terms of "value-add stages" in order to begin process improvement, and, depending on where issues are signalled, possibly the next level in terms of stage activities or steps (Figures 4a, b). Building on the work of Hoebeker (1994), these value-add stages can be considered to be groups of activities that significantly change or "transform" the value of the job or item of work passing through the process. This is fundamentally at a higher level than so-called process-mapping.

Enterprise Supply-chain Lifecycle – L2C Steps/Activities

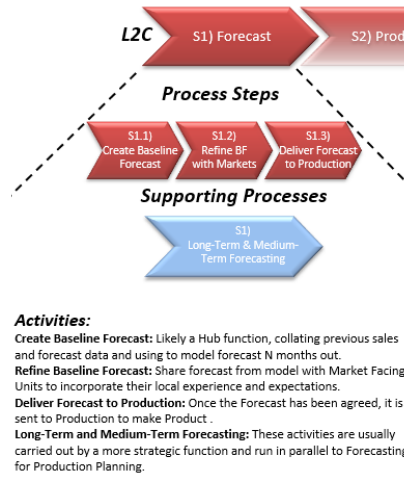
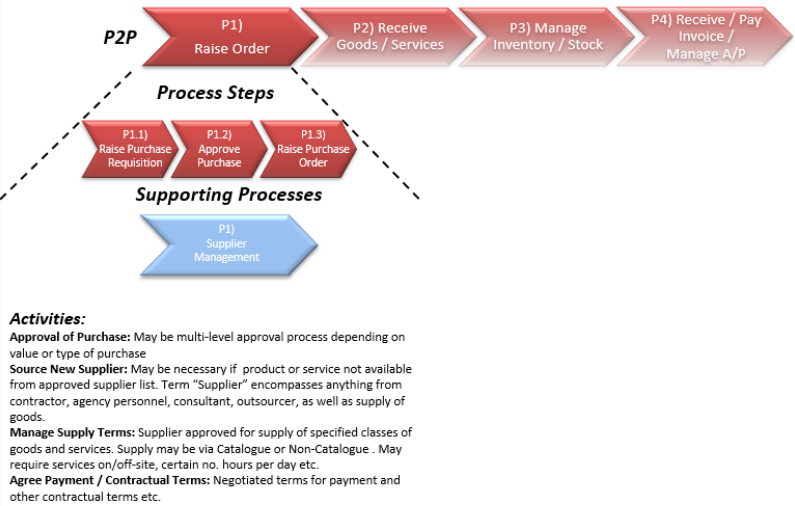


Figure 4a. L2C Process steps.

Enterprise Supply-chain Lifecycle – P2P Steps/Activities



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Figure 4b. P2P Process steps.

3. Standard set of measurement metrics for process improvement

Having established fundamental process types, their key stages and steps, at each level, there is only one coherent and consistent set of measures (or metrics) required to assess how well they are performing, see Table 1 below:

Table 1. Measurement model metrics.

End-to-End	Stages
Demand (Arrival Rate)	No. coming in
Throughput Time	Cycle Time
Completions	No. coming out
Work In Progress	Work In Progress
Cancellations	Cancellations
Outcome (Success Rate)	Quality / Rework
Operational Expense	Operational Expense
Capability (RFT)	

One of the critical metrics above is "Work In Progress", which many organisations fail to track with their plethora of BI tools. It is so critical since it determines the "Throughput Time" at the process level, or "Cycle Time" at the stage level (see, for example, Little, 2011). If L is the number of elements of work (work in progress) in the system, λ is the average arrival rate of elements of work, and W is the average wait time Eq(1):

$$L = \lambda W \quad (1)$$

The equation holds true irrespective of the distributions of the variables λ and W.

Furthermore, many organisations still make the mistake today in attempting to balance capacity (or resources capable of adding value at any stage) with demand, whereas the Theory of Constraints (Goldratt & Cox, 1984) explains that capacity should be balanced with work in progress.

4. Measurement Method

Armed with the set of measurement metrics above, improvement action can be taken without the fear of sub-optimisation (i.e. improving one metric at the expense of another in the same stage or another stage in the process).

In any business system in the real-world, demand, arrival rate, time to process etc. vary by minute, hour, day, week, month etc. Because of this variation, arithmetic methods are sub-optimal in identifying improvement opportunities. In any system where workflows through consecutive stages, variation increases through each stage. The measurement method must be statistical in nature. The most widely applicable method is Statistical Process Control (SPC) – Wheeler (2000). The authors have found that the return on investment in education / training / embedding versus improvement opportunities is easily demonstrable. For a services (including manufacturing) environment, the technique has been extended by Lightfoot to handle trends and cyclicity. In addition, it was found that language needed to be “softened” from an engineering style to a more managerial style (Wood et al., 2001). For example, Figure 5, below, shows a downward trended seasonal pattern, along with a “prediction” forward.

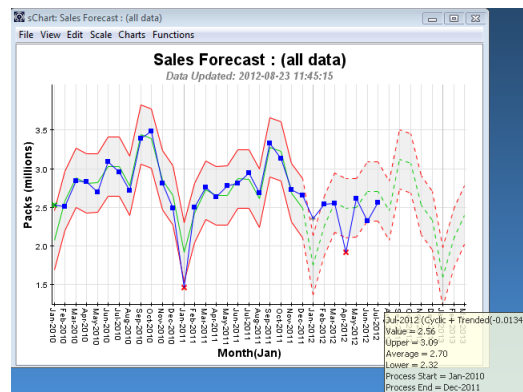


Figure 5. Statistical measurement method.

5. Findings

In order to illustrate how the approach works, and for brevity, only 1 example from a Lightfoot engagement with a global pharmaceutical follows. It is selected to highlight the advantages over methods that had been used to date. Engagements with this organisation spanned 2010 – 2014. This organisation was using its implementation of the generally accepted “Best Practice” measure for Weighted Forecast Accuracy (WFA). There are significant issues with the implementation of this measure, along with the way it is measured, two of which are i) complexity and ii) arithmetic month by month comparisons.

Complexity

Vaccines Therapy Weighted FA – October Dashboard

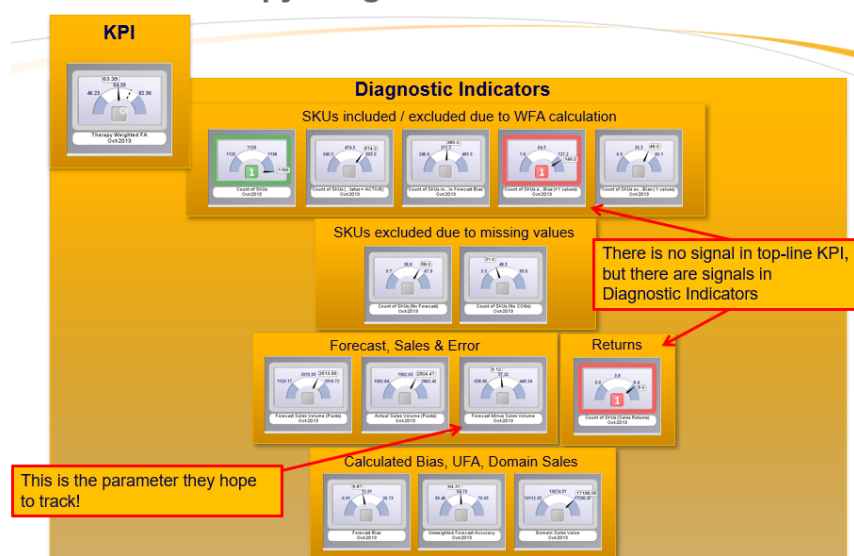


Figure 6. SPC driven dials on KPI, plus diagnostic indicators.

Current State: The metric comprises 14 independent variables, the movement of any one can mask the actual metric being measured (forecast vs sales).

Future State: Should such a complex metric be necessary, track all “diagnostic” indicators (see Figure 6 above) in order to understand (the L2C part) of their supply-chain.

Simple Metric, Statistical Drill-down:

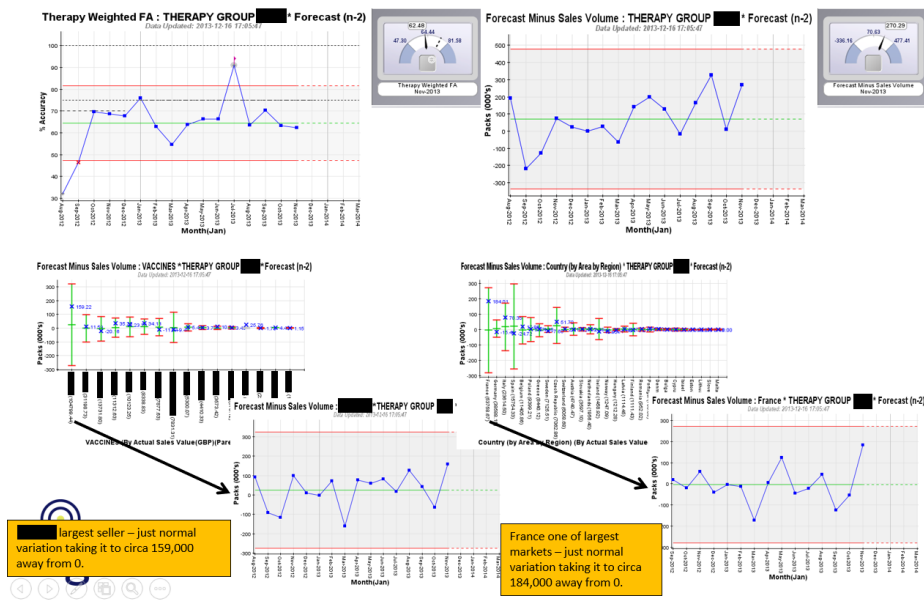


Figure 7. Track key driver of simple metric.

Arithmetic Month on Month Comparison

Current state: Track the complex metric WFA using a binary arithmetic comparison, comparing the latest month versus target and versus previous month. Whichever brand / country combination just happens to be the lowest WFA that month, have uncomfortable inquisition with those concerned. In October 2013, the inquisition landed on the brand on the left in France, where the charts (Figure 7) show that the metric that mattered (Forecast – Sales Volume) was one of the best monthly results achieved! In November 2013, using WFA, focus was directed elsewhere, when the metric that mattered was one of the worst monthly results achieved! Essentially, a team of 20 analysts working for a month, plus heated senior management discussions with the brand owner and the French market owner about October's result, achieved no change to the process performance!

Future state: The simple metric above (Forecast – Sales Volume), indicated a systemic focus (not just October 2013) on the specific brand on the left in France to gain a proper understanding with the relevant personnel to determine the root-cause and potential corrective action to the L2C process as a whole (Figure 7).

6. Conclusions

By bridging the Theory and Performance Measurement Gaps using the 2 / 4 basic process types, deploying a standard set of key measures, and applying Applied Systems Thinking appears to deliver greater benefit (as described above) than methods in use to date in the organisations engaged with. Examples quoted are now over 5 years old and are no longer sensitive. Perhaps different methods are at play in 2019, but the authors' experience is that thinking has not changed that much. With the advent of tools, such as so-called Big Data, Artificial Intelligence and Machine Learning, being deployed more widely, they must surely bring improvements to supply-chain. However, without new thinking, perhaps the greater benefits have yet to be fully grasped!

References

- Chambers, G., 2012. *Internal Research Paper*. Lightfoot Solutions, Bracknell, UK.
- Goldratt, E.M., Cox, J., 2004. *The Goal (Third Edition)*. Routledge, Abingdon, UK.
- Hoebeke, L., 1994, *Making Work Systems Better – A Practitioner's Reflections*. John Wiley and Sons, Chichester, UK
- Little, J.D.C., 2011. Little's law as viewed on its 50th anniversary. *Operations Research*, Vol. 59, No. 3, pp. 536–549.
- Supply Chain Council, 2004. *SCOR Model*, Now part of APICS. Chicago, USA
- Wheeler, D.J., 2000. *Understanding Variation: The Key to Managing Chaos*. SPC Press Inc., Knoxville, USA.
- Wood, B., Williams, R, Anker, D., Gardener, N., 2001. Performance management and improvement at the automobile association. *Supply Chain Practice*, Vol. 3, No. 1.